Proposed Plan for Record of Decision Amendment

T.H. Agriculture & Nutrition (Albany) Operable Unit 1 Superfund Site

Albany, Dougherty County, Georgia

May 2023

Introduction

The U.S. Environmental Protection Agency (EPA) is issuing this Proposed Plan to present EPA's Preferred Alternative to amend the groundwater remedy for the T.H. Agriculture and Nutrition (THAN) Superfund Site located in Albany, Dougherty County, Georgia. The Site consists of two parcels. Figure 1 on page six of this Proposed Plan shows the location of the Site. This modification is considered a fundamental change to the selected remedy.

This Proposed Plan presents the EPA's Preferred Alternative and provides the rationale for an amended remedial action to address Operable Unit 1 (OU1). EPA has designated as OU1 the remediation of ground water under the entire Site and the remediation of soil contamination on the seven-acre western portion of the Site, formerly owned by T.H. Agriculture & Nutrition, L.L.C. (the "THAN Property"). EPA has designated as Operable Unit 2 (OU2) the remediation of soil contamination on the five-acre eastern portion of the Site and is not being addressed in this Proposed Plan.

This Proposed Plan presents the Site history and a summary of the remedial alternatives evaluated in the July 2022 Focused Feasibility Study (FFS).

This amended remedial action for OU1 addresses sources of groundwater contamination, including light non-aqueous phase liquid (LNAPL) containing pesticides, volatile organic compounds (VOCs) and other contaminants of concern (COCs) and contaminated groundwater at the Site. The EPA will consider public comments on the Proposed Plan and the Selected Remedy will be presented in the final EPA decision document, the Record of Decision (ROD) Amendment for OU1.

The EPA, the lead agency, in consultation with the Georgia Environmental Protection Division (GAEPD), is issuing this Proposed Plan as part of

EPA SEEKS YOUR PARTICIPATION

Purpose: As part of public involvement during the public comment period, the community is invited to view an online presentation available on the EPA's website (below). The EPA will discuss the investigations that were conducted to support the identification of remedial alternatives as well as the reasoning for the Preferred Alternative as presented in this Proposed Plan. The EPA will be available to answer questions from the community via email or phone call.

Public Comment Period
Dates: May 10, 2023 to June 9, 2023
Purpose: To allow the community to submit comments or concerns regarding the information presented during the Public Meeting as well as the information presented in this Proposed Plan. Comments may discuss the EPA's involvement, or the remedial alternatives presented in this Proposed Plan. For more information about the remedial alternatives, visit Dougherty County Public Library to access a copy of the EPA T.H. Agriculture & Nutrition (Albany) Operable Unit 1 Site Administrative Record. These documents can also be found at the EPA T.H. Agriculture and Nutrition (Albany) Site Webpage:

https://www.epa.gov/superfund/t-h-agriculture

Dougherty County Public Library
300 Pine Avenue
Albany, Georgia 31701
Telephone: 229-420-3200
Hours:
Monday – Friday: 10:00 AM - 5:30 PM
Saturday: 10:00 AM - 4:30 PM
Sunday: Closed

its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) of 1980, as amended and Section 300.435(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This Proposed Plan summarizes and identifies key information that can be found within the Remedial Investigation (RI), Focused Feasibility Study (FFS), and other documents contained in the Administrative Record file for this Site. The EPA and the GAEPD encourage the public to review these documents to gain a more comprehensive understanding of the Site.

The public is invited to review and comment on this Proposed Plan including whether it supports the Preferred Alternative, or some other remedial alternative described in the Proposed Plan. The public comment period is scheduled to begin on April 1, 2023.

Site Background

From the 1950s to the 1980s, two former pesticide formulation and packaging facilities operated on site. Plant operations at both parcels released pesticide contamination to soil and groundwater. The western parcel had been used as a formulation and packaging plant for agricultural chemicals since the 1950's. Thompson-Hayward Chemical Company (later renamed T.H. Agriculture and Nutrition or THAN) purchased the property from Planters Chemical Company in 1967. Inventory records from the 1970's indicate the storage of the following pesticides and insecticides on the western parcel: lindane; 4,4'-dichlorodiphenyl; 1,1'-(2,2,2-Trichloroethane-1,1-diyl)bis(4-chlorobenzene) (commonly known as DDT); toxaphene; methyl parathion; malathion; and parathion.

The small warehouse that formerly existed on the western parcel was used for the storage and distribution of agricultural chemicals. The dry formulations building was used in the 1960's and 1970's to combine technical materials in the proportions specified for a particular product. The contiguous storage area to the west of the dry formulations building was used to warehouse technical materials prior to use in dry formulations. The liquid formulating area was used from approximately 1973 until approximately 1978 and contained a blending tank, a weigh scale, and a can filling apparatus. The correct amounts of liquid technical materials were combined in the blending tank, transferred to the holding tank, and the product was subsequently transferred via the can filling apparatus to containers for distribution. Wettable powders began replacing liquid formulations in approximately 1976. Very little, if any, pesticide formulating occurred at the THAN parcel after 1978.

The soil and subsurface contamination are believed to have resulted from cleaning activities. Typically, trucks were swept out in the eastern portion of the Site in the yard adjacent to the large warehouse. The blending tank in the liquid formulating area was rinsed between batches of different products with xylene and was then discharged to a drainage ditch which ran east to west across the THAN parcel, behind the liquid formulations building, to the low-lying area in the southwestern portion of the property.

The THAN company completed a RI which included a baseline risk assessment (BRA) for OU1 (THAN Parcel) in 1992. The OU1 BRA evaluated potential human exposure to sitewide groundwater, surface water and surface soils. The vapor intrusion pathway was not evaluated because the presence of compact residuum from approximately 3 ft bgs to 26 ft bgs provides a barrier to upward movement of vapors from groundwater. The BRA concluded that potential exposure to soil and groundwater resulted in cumulative risks above the EPA's upper bound of the acceptable risk range of 1×10^{-6} to 1×10^{-4} and the noncancer hazard index of 1.0 for both residential and worker exposures. In addition, the OU1 BRA identified light non-aqueous phase liquid (LNAPL) floating on the surficial aquifer (residuum) as the primary risk associated with site contamination. The predominant COCs detected in the LNAPL were volatile organics, Organophosphates (OP) pesticides, and chlorinated pesticides. Data from the 2022 annual sampling event indicates that toluene, ethylbenzene, and total xylenes are present in the LNAPL. These solvents present in the LNAPL along with dissolved pesticides are a continuing source of groundwater contamination.

The sitewide environmental risk assessment did not identify sensitive habitats or endangered species and concluded that remediation based on human health risks would eliminate ecological exposure pathways. Table 1 summarizes the primary exposure media and COCs for OU1.

Table 1: Summary of Contaminated Media and COCs

COC	OU1 Surface Soil	OU1[a] LNAPL	Sitewide Groundwater[b]
Aldrin		-	X
1,2-dibromoethane (EDB)		-	X
Alpha-hexachlorocyclohexane (alpha-BHC)		X	X
Beta-BHC		-	X
4,4'-dichlorodiphenyl; 1,1’-(2,2,2-Trichloroethane-1,1-diyl) bis (4-chlorobenzene (DDT)	NA	X	X
Dieldrin		-	X
Methyl parathion		X	-
Toxaphene		X	X
Xylene		X	-

Notes:
a. Information from Table 2 of the OU1 Record of Decision (ROD)
b. Information from Table 8 of the OU1 ROD
\- Not a contaminant of concern in this medium
COC Contaminant of concern
LNAPL Light non-aqueous phase liquid
NA According to Section 6.6 of the 1993 OU1 ROD, the removal actions in 1984 and 1992 addressed contaminated surface soil at OU1 prior to issuance of the OU1 ROD and achieved the 1×10^{-6} risk based on a future residential exposure. These response actions also eliminated unacceptable risk to environmental receptors from potential exposure to surface soil at the site. Fate-and-transport modelling conducted during the RI demonstrated that subsurface soil would not impact groundwater.
OU Operating unit
X Indicates a contaminant of concern in this medium

Previous Response Actions

At OU1, THAN completed two removal actions to address contaminated surface soil in 1984 and 1992 with GAEPD and EPA oversight, respectively. Both removal actions included demolition of buildings and structures; installation of a perimeter fence; excavation of contaminated surface and shallow soil for off-site disposal at a permitted hazardous waste landfill and thermal treatment; on-site disposal of soil; and establishment of a vegetative cover. Based on contamination discovered during the first removal action and investigations, the EPA placed the Site on the Superfund program’s National Priorities List (NPL) on March 31, 1989.

The EPA issued the Record of Decision (ROD) for OU1 in May 1993. It stated that the goal of the remedial action was to restore groundwater to its beneficial use (as drinking water). The 1993 ROD indicated surface soil remediation had been completed as part of the removal actions i.e., subsurface soil remediation was not warranted; the ROD indicated that a fate-and-transport modelling demonstrated that subsurface soil would not impact groundwater. The major components of the remedy, as outlined in the 1993 ROD and further modified in a 1995 Explanation of Significant Differences (ESD), include:

- Fencing of the Site and treatment facility
- Extraction of groundwater, for filtration prior to disposal using granular activated carbon (GAC) and ultraviolet/oxidation to be used only as a backup if the GAC did not work as expected
- Disposal of treated groundwater using infiltration wells and discharge to the Albany Wastewater Treatment Facility. If too much treated groundwater is produced for the wells, excess treated water will be discharged to the facility through the sewer line under Schley Avenue
- Use of three dual-phase vacuum extraction wells to extract groundwater and soil gas to remove LNAPL with off-site disposal of LNAPL for incineration, treatment of soil gas with activated carbon, if necessary, and groundwater treatment using GAC
- Drainage controls to divert runoff from the Site

- Quarterly inspections of the vegetative cover installed during the removal action
- Institutional controls for land use and groundwater use

The remedy also included contingency measures, including:

- Discontinue pumping at individual wells where cleanup levels have been attained
- Alternate pumping at wells to eliminate stagnation points
- Use pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater
- Install additional extraction wells to facilitate or accelerate cleanup of the contaminant plume

The OU1 1993 ROD performance standards for the COCs in groundwater are summarized in Table 2.

Table 2: OU1 Groundwater COC Cleanup Levels From the 1993 OU1 ROD

Contaminant	Cleanup Level (µg/L)[a]
1,2-dibromoethane (EDB)	0.05[b]
Aldrin	0.54[c]
Dieldrin	0.57[c]
DDT	27[c]
alpha-BHC	4.1[c]
beta-BHC	5.1[c]
Toxaphene	3.0[b]

Notes:
a. Cleanup level listed in Table 8 of the OU1 ROD. The ROD lists the units as µg/L but presents the values in milligrams per liter.
b. Maximum contaminant level (MCL)
c. 1 x 10^{-4} risk-based cleanup levels, as MCLs have not been established for these chemicals
µg/L Micrograms per liter

History of Enforcement Activities

The EPA issued Unilateral Administrative Orders to multiple Potentially Responsible Parties (PRPs) associated with the Site, directing the companies to conduct remedial design and remedial action for sitewide groundwater. In 1993, the PRPs began the remedial design. The PRPs completed the remedial design and began the remedial action in November 1995. The PRPs began construction of the groundwater extraction system in April 1996. No LNAPL was observed in the extraction system LNAPL separator during the first two years of operations; therefore, the PRPs and the EPA determined that LNAPL removal was considered ineffective and the LNAPL separator was bypassed in November 1998.

Site Characteristics

The 12-acre Site is located in a commercial and industrial area in Albany, Georgia (See Figure 1 on page six). The THAN parcel is located at 1401 Schley Avenue, on the north side of the US 82/19 bypass between Slappey Boulevard (US 19) and Palmyra Road. The THAN parcel is currently owned by VanCleave Builders, LLC (VanCleave) in 2015. Jones Family Properties, LLC owns the eastern 5 acres of the Site (the Jones Parcel, OU2). An unpaved but vegetated utility easement about 10 to 12 feet wide separates the two parcels. The THAN Parcel currently includes an office and warehouse used by the VanCleave company; the remainder of the parcel is vacant. The Jones parcel is currently being operated as a welding supply facility and an office. Both parcels are zoned for light industrial use.

Nature and Extent of Contamination

During the RI, surface and subsurface soils, groundwater, LNAPL, sediment, and surface water were collected and analyzed in accordance with the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Woodward-Clyde, November 1990). Preliminary evaluation of the detected constituents against human health based and ecological based screening criteria identified the constituents of potential concern (COPCs) at the site. Data generated during the RI was then used to perform risk assessments for the site. This entailed comparison of the COPCs concentrations with conservative human health and ecological screening levels to identify COCs for the site. Based on results of the RI, the Baseline Risk Assessment (BRA) and the Ecological Assessment (EA), COCs established in the ROD are present only in LNAPL and groundwater, as described in the subsections below. Surface and subsurface soils, sediments, and surface water are not media of concern, with rationale as provided in the ROD given below:

- Surface soil remediation on the western parcel had been completed as part of the removal actions of 1984 and 1992, and therefore, surface soil remediation was not warranted.
- Fate-and-transport modeling coupled with results of subsurface soil investigations performed during the RI demonstrated that subsurface soils on the western parcel would not contribute to groundwater contamination at concentrations exceeding the groundwater protection standards.
- Contaminants in site groundwater are not discharging to surface water bodies as the closest water body is 0.4 miles from the Site; there are no swales, drainage ditches, or intermittent streams that drain from the site directly into surface waters. Evidence from the RI showed that the zone of contamination beneath the site does not extend far enough to impact local rivers or streams.

The vapor intrusion pathway was not evaluated in the RI because the presence of compact residuum from approximately 3 ft bgs to 26 ft bgs provides a barrier to upward movement of vapors from groundwater.

Nature and Extent of Groundwater Contamination

Based on previous investigations completed and presented in the updated conceptual site model (CSM), the nature and extent of groundwater impacts have been fully defined. The most recent groundwater analytical data and results are presented in the 2022 Annual and Performance Groundwater Monitoring Report prepared by AECOM. LNAPL monitoring in 2022 and previous annual monitoring events indicates that LNAPL saturation is not widespread; monitoring well MW-N2 (located in the central portion of the Site in the upper zone of the Ocala Limestone Aquifer) is typically the only well containing measurable LNAPL.

On-site concentrations remain above 1993 ROD cleanup levels for groundwater COCs. Groundwater impacts exceeding the 1993 ROD cleanup levels are limited to the upper and intermediate zones of the Ocala Limestone aquifer. Wells with such impacts are primarily in the eastern portion of the western parcel, and western portion of the eastern parcel. Wells located in the western half of the THAN site are generally upgradient of the main former formulating and warehouse areas, although they may have been impacted by historic disposal practices. Most compounds have been reported at low levels or below detection limits in the western wells. Temporal and spatial distribution of COCs have been visually represented in three-dimensional (3-D) models using Environmental Visualization System (EVS) software. 3-D models were generated for seven COCs, including toxaphene, 1,2-dibromoethane (EDB), DDT, aldrin, dieldrin, alpha-BHC, and beta-BHC.

In order to illustrate temporal changes in plume extent, groundwater concentration data for each of the above-mentioned COCs at the site from 1991, 1996, 2001, 2006, 2011, 2016, 2017, 2018, and 2019 were used to update the models. It is to be noted that as the models were updated in September/October 2020, concentration data from the annual event in November 2020 were not included. The plume on the models is shown against a backdrop of the three distinct lithologic zones observed at the site (residuum, weathered transition zone, Ocala Limestone) to visualize the extent of impacts in the subsurface. Only concentrations exceeding cleanup levels are shown on the models.

The time series shows the shrinking of all plumes between 1991 and 2019. Most of the COCs are within the primary source area (the area between the THAN warehouse and the Jones property boundary). The beta-BHC plume is located on the western portion of the THAN property, and the dieldrin plume is located on the southwestern portion of the THAN property; but both plumes have also shrunk with time. Toxaphene has also shrunk over time, with concentrations only periodically exceeding the cleanup level at well MW-02, which is located on the western portion of the THAN property. These infrequent detections of toxaphene are likely caused by fluctuations in water levels, with a rise in water levels causing dissolution of toxaphene in groundwater compared to low groundwater conditions. The 1,2-EDB snapshots are those of 1996, because not many wells were sampled in 1991 compared to later years. Images of temporal and spatial distribution of COCs are provided in the administrative record which is available at https://www.epa.gov/superfund/t-h-agriculture.

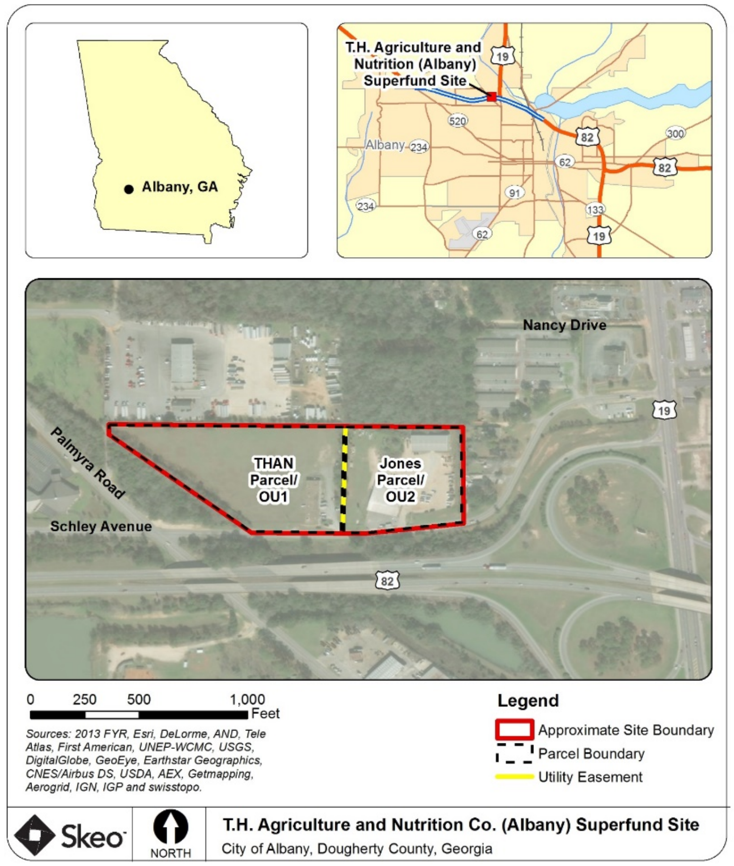
Basis for Record of Decision Amendment

The pump and treat remedy selected in the 1993 ROD was ineffective because:

- No LNAPL was observed in the extraction system LNAPL separator during the first two years of operation;
- The groundwater has not been restored to attain cleanup levels based on Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL) or health-based drinking water levels; and
- By 2003, COC concentrations remained largely unchanged (from the start of the remedy implementation), despite the PRP treating an estimated 3.5 million gallons of groundwater.

With the EPA's approval, operation of the groundwater treatment system ceased in 2003. In 2003, the PRP began a bioremediation pilot study designed to reduce concentrations of COCs in the Site's subsurface soils to minimize the potential for leaching to groundwater. After testing various reagents, the PRP concluded that bioremediation was ineffective at reducing contaminant concentrations. The EPA confirmed this conclusion in November 2009. The PRP continued to monitor groundwater contamination trends and plume migration and evaluate other options for the treatment of site groundwater, and if necessary, consider implementing the 1993 ROD's contingency.

Figure 1 Location of the T.H. Agricutlure and Nutrition (Albany) Site



In 2013, the EPA evaluated groundwater contaminant trends and plume migration and determined that the groundwater plumes were not migrating laterally. However, the EPA concluded that concentrations of some contaminants were increasing in deeper wells as a result of vertical migration from the shallow zone. Following the EPA's analysis, the EPA requested that the PRP evaluate other possible remedies to address the vertical migration of contamination. In response, the PRP prepared a work plan in May 2016 that the EPA approved in April 2017. The scope of work outlined in the work plan has been completed, including delineation of the LNAPL area using the Ultraviolet Optical Screening Tool (UVOST), sampling of subsurface soils, Synthetic Precipitation Leaching Procedure analysis of selected site COCs, and completion of a thermal conductive heating bench-scale study.

The lens of LNAPL remains in site groundwater, typically measurable in monitoring well MW-N2, and provides a mechanism for the release of COCs to groundwater. Composition of the LNAPL includes ethylbenzene and xylene as the most prevalent VOCs; toxaphene and alpha-BHC as the most common organochlorine pesticide/insecticides (OCP), and methyl parathion as the common OP. Most of the OCPs and OPs at the Site are not readily soluble in water. The VOCs in the LNAPL, which can act as a solvent for pesticides, may increase the solubility of these pesticide compounds and, thus, create a mechanism for release into groundwater.

Principal Threat Waste

The National Contingency Plan (NCP) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(III)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material or waste that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or act as a source for direct exposure.

Contaminated groundwater is not considered to be a source material. However, LNAPL in groundwater is viewed as source material. Principal threat waste in the form of LNAPL and residual LNAPL in saturated soil is present on site. As mentioned, composition of the LNAPL includes ethylbenzene and xylene as the most prevalent VOCs; toxaphene and alpha-BHC as the most common OCPs, and methyl parathion as the common OP. LNAPL monitoring in 2022 and previous annual monitoring events indicates monitoring well MW-N2 regularly contains measurable LNAPL and newly installed nearby wells MW-47U and MW-48U also contained LNAPL. The LNAPL serves as a carrier for the other site related COCs (pesticides). Removal of the LNAPL would result in reductions in pesticide groundwater concentrations due to their high adsorption affinity for soil.

Scope and Role of the Response Action

This Proposed Plan recommends a fundamental change to the groundwater remedy for OU1 originally selected and implemented under the 1993 ROD. The Preferred Alternative in this Proposed Plan will address remaining LNAPL with Air Sparge and Soil Vapor Extraction (AS/SVE). EPA considers the remaining LNAPL a principal threat waste. This proposed action is consistent with EPA's cleanup strategy for groundwater – to treat source areas with aggressive technologies, where practicable, and to treat the dissolved plume with less aggressive technologies.

In 1996, EPA implemented the groundwater pump and treatment remedy selected in the 1993 ROD. After several years of operation, EPA determined the remedy was unable to efficiently remove and treat the residual LNAPL present in the surficial aquifer. The previous remedy was unable to restore groundwater at the Site within a reasonable timeframe to attain established cleanup levels based on Federal SDWA MCLs or human health-based drinking water levels established at 1×10^{-4} risk level. The Preferred Alternative identified in this Proposed Plan is necessary to address principal threat waste LNAPL source material remaining in the subsurface that is leaching COCs into the groundwater.

This Proposed Plan provides the rationale for amending the selected remedy for OU1 in the 1993 ROD, based on the results of the 2019 and 2021 pilot studies. Air Sparge (AS) is a well-established treatment technology for remediating VOCs with the ability to reduce LNAPL mass and significantly reduce dissolved concentrations. Soil Vapor Extraction (SVE) would be utilized to extract and contain vapors generated by AS operations. Based on the 2021 field pilot study, AS/SVE is expected to significantly reduce the LNAPL carrier solvent mass. After the LNAPL plume is significantly reduced or eliminated, in-situ chemical reduction (ISCR) and Enhanced Anaerobic Biodegradation can be implemented to address remaining pesticides in groundwater. Results from the 2019 pilot study showed that direct injection was successful in emplacing the amendments within the target weathered Ocala Limestone; groundwater chemistry revealed significant changes in conductivity, oxygen reduction potential (ORP), and dissolved oxygen (DO); and showed progressively decreasing concentrations of site specific COCs.

EPA intends to conduct the preferred remedial action in two phases. The first phase will eliminate the LNAPL plume which will minimize any vertical or lateral pesticide migration, and the second phase will address the pesticide contaminants in the dissolved phase or non-LNAPL plume.

Summary of Site Risks

A Baseline Risk Assessment (BRA) was conducted in 1992 to determine the current and future effects of contaminants on human health and the environment. The results of the risk assessment provide the basis for taking action and identifying contaminants and exposure pathways that need to be addressed by the remedial action.

The Site's human health risk assessment, summarized in the 1993 ROD, evaluated potential risks associated with the floating lens of LNAPL located in the surficial aquifer. The LNAPL contains elevated concentrations of spent solvents and pesticides, which have toxic properties and is considered Resource Conservation and Recovery Act (RCRA) hazardous waste. The threat posed by stained source area soil to public health and the environment was eliminated when contaminated soils were excavated and thermally treated at the Site in 1984 and 1992 removal actions. The 1993 ROD indicated that site surface soil no longer poses unacceptable risks from direct contact exposure to soil, since the soils have been remediated.

Based on exposure pathways identified in the 1993 ROD, the main concern remaining pertains to the potential exposure to various contaminants from contaminated groundwater beneath and downgradient of the Site. In 2013, the EPA evaluated groundwater contaminant trends and plume migration and determined that groundwater plumes were not migrating laterally. However, the EPA concluded that concentrations of some contaminants were increasing in deeper wells as a result of vertical migration from the shallow zone. Data from the 2022 Annual Groundwater sampling confirms contaminants have not migrated off-site. Furthermore, current evidence shows that the zone of contamination beneath the Site does not extend far enough to impact local rivers or streams. Table 3 below lists the sites COCs.

Table 3: Site Specific COCs

COC	OU1 Soil	OU1[a] LNAPL	OU2[b] Surface Soil	OU2[b] Subsurface Soil	Sitewide Groundwater[c]
Pesticides/Herbicides					
Aldrin	NA				X
EDB				X	X
Alpha-hexachlorocyclohexane (alpha-BHC)		X			X
Beta-BHC					X
Dichloro-diphenyltrichloroethane (DDT)		X	X		X
Dieldrin					X
Methyl parathion		X		X	
Toxaphene		X	X		X
Xylene		X			
Metals					
Manganese	NA			X	

Notes:
c. Information from Table 2 of the OU1 Record of Decision (ROD)
d. Information from Table 8 of the OU2 ROD
e. Information from Table 8 of the OU1 ROD
NA = according to Section 6.6 of the 1993 OU1 ROD, the removal actions in 1984 and 1992 addressed contaminated surface soil at OU1 prior to issuance of the OU1 ROD and achieved the 1×10^{-6} risk based on a future residential exposure.
Blank = contaminant not a COC in this medium

Remedial Action Objectives (RAOs)

Before developing remedial alternatives for a Superfund site, EPA establishes RAOs to protect human health and the environment. RAOs are specific goals to address a particular media and exposure pathway(s) at the Site in view of protecting human health and the environment. These objectives can include preliminary remediation goals (PRGs) that become cleanup levels in the decision document and are based on available information and standards, such as Applicable or Relevant and Appropriate Requirements (ARAR), to-be-considered (TBC) guidance, and site-specific, risk-based levels. The RAOs identified in the ROD are being modified to better reflect the objectives and scope of the amended remedy.

The RAOs for this proposed remedial action are:

- Prevent human exposure to COCs in groundwater through ingestion and/or dermal contact above Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL) or health-based drinking water levels
- Reduce the mass of the LNAPL and prevent any further migration of COCs leaching into groundwater
- Restore groundwater throughout the plume to attain SDWA MCLs or health-based drinking water levels within a reasonable timeframe.

Groundwater Cleanup Levels

Table 4 on the following page lists the Site's proposed groundwater cleanup levels. The cleanup levels for COCs are based on EPA SDWA MCLs or health-based drinking water levels based on human health carcinogenic risks at 1 x 10^{-5} when MCLs do not exist for that COC. Cleanup levels that achieve risks of 1 x 10^{-6} cannot be verified with current approved analytical methods. Current laboratory analytical method detection limits for USEPA Method 8081B (organochlorine pesticides) and USEPA Method 504.1 (EDB, DBCP, and 1,2,3-TCP) are either at or just below (able to reliably detect) the proposed cleanup levels for EDB, aldrin, and alpha BHC. The method detection limit for dieldrin is 0.0274 micrograms per liter (µg/L) which is slightly above the groundwater cleanup level of 0.018 µg/L.

Achieving human health carcinogenic risks of 1 x 10^{-5} would meet EPA's upper bound of the acceptable cumulative risk range of 1 x 10^{-6} to 1 x 10^{-4} and the noncancer hazard index of 1.0 for both residential and worker exposures. Table 4 below provides the proposed groundwater cleanup levels.

Table 4 Groundwater Cleanup Levels

Contaminant of Concern	Groundwater Cleanup Level (µg/L)	Basis
1,2-dibromoethane (EDB)	0.05	Federal MCL
Aldrin	0.0092	HHCR of 1 x 10^{-5}
Dieldrin	0.018	HHCR of 1 x 10^{-5}
DDT	2.3	HHCR of 1 x 10^{-5}
Alpha-benzenehexachloride (BHC)	0.073	HHCR of 1 x 10^{-5}
Beta-BHC	0.25	HHCR of 1 x 10^{-5}
Toxaphene	3.0	Federal MCL
Xylene	10,000	Federal MCL

Notes:
HHCR Human health carcinogenic risk
MCL Maximum contaminant level
µg/L Microgram per liter

Groundwater Remedial Alternatives

EPA intends to conduct the preferred remedial action in two phases. The first phase will attempt to eliminate the LNAPL plume which will minimize any vertical or lateral pesticide migration, and the second phase will address the pesticide contaminants in the dissolved phase or non-LNAPL plume. Four alternatives were considered for the LNAPL area (which includes both VOCs and pesticides) and three alternatives were considered for the non-LNAPL (pesticides groundwater plume) and are summarized below.

LNAPL Alterative 1 – No Action

Evaluation of the no-action alternative is required by the NCP for feasibility studies for consideration as a baseline for comparison and is retained to maintain general accordance with the structure of a feasibility study. Alternative 1 would not include any remedial actions. In addition, unlike the remaining alternatives, no groundwater monitoring would be performed to assess changes in COC concentrations over time.

No Action Costs	
Capital Cost	$0
Net Present Worth (NPW) O&M Cost	$0
O&M Period (years)	NA

LNAPL Alternative 2 – ISCR and Enhanced Anaerobic Biodegrading

Alternative 2 includes injection of zero-valent-iron (ZVI), carbon substrate, and nutrients to chemically degrade COCs in-situ within the LNAPL area. Similar to recent pilot testing, injection substrate would likely include EHC® ISCR Reagent although dozens of other commercially available ZVI and carbon substrate products could be considered. Injections would likely be performed via direct push drilling rods based on the pilot test conclusions.

Injections would target the saturated portion of the residuum and the Upper Ocala Limestone where potential residual LNAPL and elevated COC concentrations have been identified. The pilot test injection of EHC® ISCR Reagent via direct push borings was completed with approximately 13-foot spacing between injection borings. Based on the LNAPL area targeted (approximately 36,000 square feet), approximately 213 borings would be required. Vertical injection intervals would be determined based on review of available monitoring well data and EVS models depicting high resolution lithology data (via cone penetration testing [CPT] and hydraulic profiling tool [HPT]) within the LNAPL area. The majority of the area targeted for injection is readily accessible. Areas with limited access, such as the existing building and utility right-of-way, would be treated by installing angled injection borings.

Performance monitoring would be necessary to confirm effectiveness. Based on this monitoring, multiple injection events may be required to reach remedial objectives and attain cleanup levels. Injection events would likely be completed over the course of 3 or 4 years to sustain conditions for continued COC degradation. It should be noted that while a series of remedial injections would accelerate groundwater COC concentration reductions, several years of post-injection monitoring would likely be required to reach groundwater cleanup levels for all COCs within the LNAPL area.

ISCR and Enhanced Anaerobic Biodegrading Costs	
Capital Cost	$971,200
Net Present Worth (NPW) O&M Cost	$2,735,700
O&M Period	9 years
Total Estimated Cost	$3,706,900

LNAPL Alternative 3 – Air Sparging

Alternative 3 includes installation of air injection wells throughout the LNAPL area. Based on pilot test conclusions, AS wells would be screened both within the Upper Ocala Limestone, approximately 10 feet below residual LNAPL, and deeper within the Intermediate Ocala Limestone where higher air injection flow rates are achievable. Air would be injected into the AS well network to enhance volatilization and aerobic biodegradation of LNAPL. Composition of the LNAPL includes ethylbenzene and xylene as the most prevalent VOCs, which will be easily volatilized by the AS system. Although the site COCs are pesticides which have low volatility, the removal of LNAPL which serves as a carrier for the OCPs may result in reductions in pesticide groundwater concentrations if currently dissolved pesticide mass adsorbs to soil following removal of the LNAPL solvent.

The alternative would also include the installation of SVE wells to capture VOC vapors generated during AS operations. Effluent emissions will be captured with a device such as an air stripper or GAC system.

There is approximately 18 to 26 ft of very tight red residual clay (Residuum) associated with xylene and ethylbenzene groundwater plume on the THAN and Jones properties. Therefore, indoor vapor intrusion is currently considered an incomplete pathway. Because the implementation of the remedy has a potential for creating a vapor intrusion pathway, a VI evaluation will be conducted based on the specific groundwater VOCs (xylenes and ethylbenzene) during the design and prior to installation of the angled AS/SVE wells under the building. Site-specific screening will be performed to determine if further VI investigation and mitigation are warranted. The VOC concentrations in groundwater samples from the Residuum and Upper Ocala aquifer monitoring wells located within 50 feet of the structures on the THAN and Jones properties will be screened to assess whether they are above commercial EPA Vapor Intrusion Screening Levels (VISL) for xylenes and ethylbenzene. If necessary, soil gas samples will be collected to further evaluate the potential for vapor intrusion in the areas of the site where groundwater data indicate the highest potential vapor intrusion exposures. The maximum detected VOC concentrations will be used as conservative input assumptions for further evaluation of potential vapor intrusion exposures. Design of the AS/SVE system will include SVE wells installed as angled wells under the building in order to protect the building's occupants from potential VI exposure when the system is operational. VI monitoring will be conducted during implementation to ensure there is no risk of exposure to the building occupants. Minimal volatilization of pesticides could also be anticipated. The majority of the area targeted for AS and SVE well installation is readily accessible. Areas with limited access, such as the existing building and utility right-of-way, would be treated by installing angled wells.

Based on the LNAPL area targeted (approximately 36,000 square feet), approximately 85 AS wells and 62 SVE wells can be estimated based on pilot study radius of influence (ROI) recommendations. An equipment enclosure would be designed and assembled off-site and delivered to the site for connection to the AS and SVE well network. Equipment would include an air compressor, vacuum blower, and associated controls. The equipment would be connected to an electrical service and piping would be installed between each AS and SVE wells and the equipment enclosure. The system would be operated for at least two years during which groundwater performance monitoring and influent SVE vapor sampling would be conducted to assess remediation progress and to support system adjustments and optimization. It should be noted that while AS/SVE system operation would reduce residual LNAPL mass and dissolved total xylenes concentrations, and accelerate groundwater COC concentration reductions, several years of post-AS/SVE groundwater monitoring would likely be required to verify that groundwater cleanup levels for all COCs within the LNAPL area (i.e. no rebound of pesticides), as the basis for the reduction in pesticide concentrations would be their sorption to soil after removal of the LNAPL carrier solvent if only AS/SVE is selected for implementation.

Air Sparging and Soil Vapor Extraction Costs	
Capital Cost	$3,725,250
Net Present Worth (NPW) O&M Cost	$1,347,600
O&M Period	3 years
Total Estimated Cost	$5,072,850

LNAPL Alternative 4 – Thermal Treatment

Alternative 4 includes installation of thermal conductive heating wells throughout the LNAPL area. Thermal conductive heating (TCH) is typically used to heat the subsurface to approximately 100°C but can also reach temperatures as high as 335°C. Heat would be applied to the interval containing residual LNAPL to enhance desorption, volatilization, and degradation of LNAPL and volatile compounds; higher temperatures can cause the degradation of organochlorine pesticides via dechlorination. The alternative would also include the installation of SVE wells to capture vapors generated during thermal treatment to mitigate any potential VI risk: mostly volatile petroleum hydrocarbons and limited OCPs. Based on previous bench scale testing conducted by AECOM, a temperature of 160°C would be required to effectively treat all site COCs, primarily via decomposition (dechlorination). Site-specific pilot testing has not been performed to assess implementability and a small-scale pilot test would likely be required prior to full-scale application.

Based on conceptual design, approximately 345 steel heater probe wells and 21 temperature monitoring probes would be required to cover the 36,000 square foot LNAPL area. In addition, based on the AS/SVE pilot test ROI recommendations, approximately 62 SVE wells would be required to control vapors. Heater borings would consist of 4 to 6-inch diameter boreholes with 3-inch diameter steel casings (“heater cans”). The heater borings will have no screened section and will be fully set in high temperature grout to prevent migration pathways along the heater boring annulus. SVE wells and LNAPL area monitoring wells would need to be constructed (or reconstructed) of heat resistant material. Areas with limited access, such as the existing building and utility right-of-way, would be treated by installing angled wells. The majority of the areas targeted for thermal are readily accessible. However, areas with limited access, particularly within the existing building, will present logistical difficulty given the significant aboveground wiring and piping required for thermal treatment.

The entire targeted saturated zone would need to be dewatered to effectively heat the targeted area to 160°C. As such, very significant additional cost and effort would be required to install wells, dewatering pumps, and groundwater treatment equipment to maintain dewatering throughout the period of thermal treatment. A detailed design of the dewatering well network and P&T equipment has not been developed for this initial evaluation.

The system would be operated for several months to a year (initial estimate of 289 days) during which temperature probe monitoring, groundwater performance monitoring, and influent SVE vapor sampling would be conducted to assess remediation progress and to support system adjustments and optimization. Several years of post-treatment groundwater monitoring would likely be required to confirm that groundwater cleanup levels are met and maintained (i.e. no rebound) for all COCs within the LNAPL area.

Thermal Treatment Costs	
Capital Cost	$11,004,000
Net Present Worth (NPW) O&M Cost	$3,374,400
O&M Period	7 years
Total Estimated Cost	$14,378,400

Non-LNAPL Groundwater Alternative 1 – No Action

Evaluation of the no-action alternative is required by the NCP for feasibility studies for consideration as a baseline for comparison and is retained to maintain general accordance with the structure of a feasibility study. Alternative 1 would not include any remedial actions. In addition, unlike the remaining alternatives, no groundwater monitoring would be performed to assess changes in COC concentrations over time.

No Action Costs	
Capital Cost	$0
Net Present Worth (NPW) O&M Cost	$0
O&M Period (years)	NA

Non-LNAPL Groundwater Alternative 2 – Monitored Natural Attenuation

Alternative 2 includes monitored natural attenuation (MNA) of COCs in groundwater, rather than active remediation. Tables of historical analytical data in the 2022 Focused Feasibility Study and the Mann Kendall trend graphs presented in the 2020 Groundwater Monitoring Report show an overall clear and meaningful trend of decreasing concentrations for the site COCs, especially for the last 15 years. Active remedial action last occurred at THAN in 2003. These pesticides do not degrade readily but there are detections of chloride ions which indicates that these organochlorine pesticides are breaking down slowly. Additionally, the treatment and removal of the xylene (pesticide solvent) will allow the sorption of the pesticides onto the aquifer materials and no longer being in the aqueous phase. And undoubtedly, a portion of future reduction may be attributed to dilution.

Please note that the major exception to a monitored natural attenuation remedy are the xylene concentrations which will be the primary target of these proposed remedial actions. Additionally, this project includes a remedial management framework that allows for the performance of a remedial treatment and then a period of monitoring. If the COCs are not attenuating, additional treatments will be applied to the remaining contaminant mass, followed by additional monitoring.

COC concentrations would be monitored to confirm a stable or shrinking plume and continued decreases towards groundwater cleanup levels. For this specific site, groundwater monitoring would include “performance monitoring” of COC concentration decreases resulting from upgradient LNAPL area remediation in addition to COC concentration decreases resulting from natural processes such as advection, dispersion, dilution, volatilization, biodegradation, adsorption, and chemical reactions with natural minerals.

The primary component of Alternative 2 would be monitoring of COC concentrations to confirm plume stability and assess COC concentrations trends over time. However, select parameters such as dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, total organic carbon (TOC), and chloride will also be monitored to evaluate mechanisms for natural COC degradation.

Monitored Natural Attenuation Costs	
Capital Cost	$213,600
Net Present Worth (NPW) O&M Cost	$729,000
O&M Period	10 years
Total Estimated Cost	$942,600

Non-LNAPL Groundwater Alternative 3 – ISCR and Enhanced Anerobic Biodegradation

Alternative 3 includes injection or trench emplacement of ZVI, carbon substrate, and nutrients to chemically degrade dissolved and adsorbed COCs outside of the LNAPL area. Similar to recent pilot testing, injection substrate would likely include EHC® ISCR Reagent although dozens of other commercially available ZVI and carbon substrate products could be considered. Injections would primarily be designed to reduce concentrations and mitigate off-site migration of toxaphene, although remediation and containment of other dissolved plume COCs will be incorporated where practical. The use of temporary direct push borings is anticipated for amendment injection, although the semipermanent injection wells or slurry trench installation may be considered. Vertical injection intervals would be determined based on review of available monitoring well data and EVS models depicting high resolution lithology data (via CPT and HPT) within each targeted lobe of the plume.

Performance monitoring would be necessary to confirm long-term reactivity and effectiveness. Based on this monitoring, periodic injection events may be required to replenish substrate. It should be noted that while injections would accelerate groundwater COC concentration reductions, achieving groundwater cleanup levels would likely require several years of post-injection groundwater monitoring.

ISCR and Enhanced Anerobic Biodegradation Costs	
Capital Cost	$971,200
Net Present Worth (NPW) O&M Cost	$2,735,700
O&M Period	9 years
Total Estimated Cost	$3,706,900

Evaluation of Alternatives

In evaluating the remedial alternatives, each alternative is assessed against nine evaluation criteria set forth in the NCP at 40 CFR § 300.430(e)(9)(iii). The remedial alternative selected for a Superfund site must meet the two threshold criteria, as well as attain the best balance among the five balancing criteria. State and community acceptance are evaluated after the close of the public comment period. EPA, after considering state acceptance and public comments received on this Proposed Plan, will select the final groundwater remedy in an Amended ROD. EPA's Preferred Alternative may be altered or changed based on the two modifying criteria.

This section of the Proposed Plan profiles each alternative's relative performance against the nine evaluation criteria. It notes how each remedial alternative compares to other options under consideration. The 2022 Focused Feasibility Study Report includes a detailed analysis of the alternatives and information about the evaluation process.

The first two criteria are known as "threshold criteria" because they are the minimum requirements that each CERCLA response measure must meet to be eligible for selection as a remedy.

EPA determined that the No Action alternative is not a viable alternative for remedy selection because it does not meet the threshold criteria. The No Action alternative was developed as a baseline for comparative analysis purposes. The alternative would not eliminate the hazard posed to receptors by on-site contamination. LNAPL and groundwater contamination would remain.

Because the No Action alternative does not meet the threshold criteria, the remainder of the comparative analysis only includes three LNAPL alternatives and two Non-LNAPL Groundwater alternatives. The alternatives have been renumbered from the 2022 Feasibility Study Report discussion of site-specific alternatives:

- LNAPL Alternative 1 – ISCR and Enhanced Anaerobic Biodegradation
- LNAPL Alternative 2 – Air Sparging/Soil Vapor Extraction
- LNAPL Alternative 3 – Thermal Treatment
- Non-LNAPL Groundwater Alternative 1 – Monitored Natural Attenuation
- Non-LNAPL Groundwater Alternative 2 – ISCR and Enhanced Anaerobic Biodegradation

THE NINE SUPERFUND EVALUATION CRITERIA

Threshold Criteria:

1. **Overall Protectiveness of Human Health and the Environment** evaluates whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
2. **Compliance with ARARs** evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to a site, or whether a waiver is justified.

Balancing Criteria:

3. **Long-term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
4. **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. **Short-term Effectiveness** considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.
6. **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. **Cost** includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50% to -30%.

Modifying Criteria:

8. **State/Support Agency Acceptance** considers whether the state agrees with EPA's analyses and recommendations, as described in the RI Report, the FS Report, and the Proposed Plan.
9. **Community Acceptance** considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Criterion #1: Overall Protection of Human Health and the Environment (HH&E):

All active LNAPL alternatives would be protective of human health and the environment by removing and treating the largest mass of COCs in the source area. Non-LNAPL Alternative 1 would not include active remediation but rather monitor natural attenuation of COCs to confirm a stable or shrinking plume after removal of the solvent plume which is thought to be the carrier for Non-LNAPL COCs. Non-LNAPL Alternative 2 would be protective of human health and the environment by treating the largest mass of COCs in the source area.

Criterion #2: Compliance with ARARs:

Section 121(d)(2) of CERCLA and NCP at 40 C.F.R. §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites attain legally applicable or relevant and appropriate federal and more stringent state environmental requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4). See NCP Definitions of 'Applicable requirements' and 'Relevant and appropriate requirements' at 40 C.F.R. 300.5.

Chemical-specific ARARs include the SDWA MCLs. Action-specific ARARs include requirements for underground injection wells, control of VOC emissions from site remediation, construction and abandonment of monitoring wells and management of contaminated soil and groundwater generated during cutting/drilling wells in accordance with waste management regulations. The ARARs for the selected remedy will be included in the ROD and no waiver under CERCLA section 121(d)(4) is expected.

LNAPL Alternatives

- Alternatives 1, 2, and 3, are expected to comply with above action-specific ARARs related to treatment through injection wells and extraction wells, and capture of emissions.

Non-LNAPL Groundwater Alternatives

- Alternative 1 would be expected to eventually meet chemical-specific ARARs given the natural degradation processes and continued monitoring would be performed until COC concentrations attain Federal MCLs or health based drinking water values.
- Alternative 2 would be expected to comply with chemical specific ARARs by reducing COC concentrations in groundwater within and downgradient of the injection(s) via adsorption and in-situ chemical and biological degradation. The time for restoration of the groundwater is significantly lower than with Alternative 1 due to active treatment of the COCs.

Criterion #3: Long-Term Effectiveness and Permanence:

According to the NCP at 40 C.F.R. §430(e)(9)(iii)(C)(1) and (2), alternatives shall be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Factors that shall be considered, as appropriate, include the following:

- Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals should be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate.

- Adequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage treatment residuals and untreated waste. This factor addresses in particular the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative, such as a cap, a slurry wall, or a treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

EPA expects that each of these remedial alternatives, by treating or containing the contamination deep in the subsurface beneath the Site, will address the sources of groundwater contamination, dissolved phase contaminated groundwater and remaining risk of exposure present at the Site. It should be noted that the exposure risk from surface soil contamination was already greatly lowered by the earlier cleanup actions at the Site.

The remedial alternatives and the Site are not vulnerable to impacts from climate change. The contamination is in the deep subsurface. Due to the site location and construction of the remedial components are not vulnerable to storms, floods, fires, droughts, or other climate change impacts.

LNAPL Alternatives

- Alternative 1 is anticipated to provide long-term effectiveness. The objective of injection would be to treat the COCs in-situ and should not leave significant COC mass in place (e.g., containment) or produce residuals requiring management or disposal.
- Alternative 2 is anticipated to provide long-term effectiveness. The objective of air sparging would be to attenuate the COCs in-situ and should not leave significant COC mass in groundwater (e.g. containment) after removal of the LNAPL “carrier solvent”.
- Alternative 3 is anticipated to provide long-term effectiveness. The objective of thermal treatment would be to treat the COCs in-situ and should not leave significant COC mass in place (e.g. containment).

Non-LNAPL Groundwater Alternatives:

- Alternative 1 would eventually produce long-term effectiveness related to reducing dissolved plume COC mass permanently.

- Alternative 2 is anticipated to provide long-term effectiveness. The objective of injection would be to permanently treat the COCs in-situ and would not produce residuals requiring management or disposal.

Criterion #4: Reduction of Toxicity, Mobility, or Volume Through Treatment:

This criterion addresses the preference under CERCLA for remedial alternatives that permanently and significantly reduce the mobility, toxicity, or volume of hazardous substances through treatment. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

LNAPL Alternatives

- Alternative 1 would result in the reduction of toxicity, mobility, and volume of COCs adsorbed to soil and dissolved in groundwater. ISCR and enhanced anaerobic biodegradation are specifically expected to be effective in degrading chlorinated pesticide COCs to less toxic or completely inert byproducts. Although enhanced anaerobic biodegradation can be effective at treating petroleum hydrocarbons, previous pilot studies have not proven its effectiveness at treating LNAPL, which acts as a "carrier solvent". LNAPL removal is critical to mobility reduction at the site and may not be feasible via Alternative 1.
- Alternative 2 would result in the reduction of toxicity, mobility, and volume of COCs adsorbed to soil, dissolved in groundwater, and/or contained in LNAPL. The volume of volatile COCs (EDB) and total xylenes, would be substantially reduced while limited pesticide volatilization and aerobic degradation may occur during air sparging. SVE will assist in removal and capture of any volatilized COCs. The anticipated reduction in residual LNAPL mass would also reduce the mobility of pesticide COCs by eliminating a primary mechanism for low-solubility COCs to impact groundwater.
- Alternative 3 would result in the reduction of toxicity, mobility, and volume of COCs adsorbed to soil, dissolved in groundwater, and contained in LNAPL. In addition, the anticipated reduction in residual LNAPL mass would also reduce the mobility of COCs by eliminating a primary mechanism for low-solubility COCs to impact groundwater.

Non-LNAPL Groundwater Alternatives

- Alternative 1 will achieve mass decreases from natural processes such as dispersion, dilution, volatilization, biodegradation, and chemical reactions with natural minerals. With some reactions creating less-toxic end products or end-products with greater adsorption to soil.
- Alternative 2 would result in the reduction of toxicity, mobility, and volume of dissolved COCs by treating impacts in-situ. ISCR and enhanced anaerobic biodegradation are expected to be effective in degrading chlorinated COCs to less toxic or completely inert byproducts. This is appropriate given that reduction and immobilization of OCPs would be the primary objective for non-LNAPL area remediation.

Criterion #5: Short-Term Effectiveness:

This criterion considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

LNAPL Alternatives:

- Alternative 1 would introduce manageable risks to construction workers from exposure to soil and groundwater during injection implementation. Following injections, COC reductions in groundwater would not be immediate but accelerated concentration decreases would be expected to be observed within a relatively short period of time following implementation.
- Alternative 2 would introduce manageable risks to construction workers from exposure to soil, groundwater, and vapors during well installation and system operation. Following system activation, COC reductions in groundwater would not be immediate but accelerated concentration decreases would be expected to be observed within a relatively short period of time following implementation. Air sparging will generate subsurface vapors which could reach human receptors but will be captured and treated via SVE. VI monitoring will be performed during remedy implementation.

- Alternative 3 would introduce manageable risks to construction workers from exposure to soil, groundwater, and vapors during well installation and system operation. Following system activation, COC reductions in groundwater would not be immediate but accelerated concentration decreases would be expected to be observed within a relatively short period of time following implementation. Thermal treatment will generate subsurface vapors which could reach human receptors but will be captured and treated via SVE. VI monitoring will be performed during remedy implementation.

Non-LNAPL Groundwater Alternatives

- Alternative 1 would introduce limited risks to groundwater sampling personnel, although risks would be minimal as compared to worker exposure during implementation of Alternative 2. COC concentrations would not be expected to decrease in the short-term.
- Alternative 2 would introduce manageable risks to construction workers from exposure to soil and groundwater during injection events. Following injections, COC concentration decreases would be expected to be observed within a relatively short period of time following implementation.

Criterion #6: Implementability:

This criterion considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

LNAPL Alternatives

- Alternative 1 can be implemented with readily available equipment and materials and has been demonstrated as feasible based on site-specific pilot testing. ISCR and enhanced anaerobic bioremediation amendments are widely available and can be applied using standard industry practices. The majority of the area targeted for injection is readily accessible and areas with limited access, such as the existing building and utility right-of-way, can be treated by installing angled injection borings.
- Alternative 2 can be implemented with readily available equipment and materials and has been demonstrated as feasible based on site-specific pilot testing. Air sparging is a very common and widely used remediation technology and can be implemented using standard industry practices. The majority of the areas targeted for injection are readily accessible and areas with limited access, such as the existing building and utility right-of-way, can be addressed by installing angled air sparging wells.
- Alternative 3 can be implemented with readily available equipment and materials but must be performed by a specialty thermal contractor. Site-specific pilot testing has not been performed to assess implementability and a small-scale pilot test would likely be required prior to full scale application. In addition, a temperature of at least 160°C (and very high energy usage) would be required to degrade pesticide COCs. This alternative would also have the largest carbon footprint of any of the alternatives considered.

Based on input from a Thermal contractor, the entire targeted saturated zone would need to be dewatered to effectively heat the targeted area to 160°C. As such, very significant additional cost and effort would be required to install trenches, wells, and/or impermeable barrier walls and to extract and treat groundwater during the period of thermal treatment.

Non-LNAPL Groundwater Alternatives

- Alternative 1 can be easily implemented by modifying and continuing the current sampling regimen at the site.
- Alternative 2 can be implemented with readily available equipment and materials and has been demonstrated as feasible based on site-specific pilot testing. ISCR and enhanced anaerobic bioremediation amendment are widely used and can be applied using standard industry practices. Based on existing site conditions and access, likely areas for non-LNAPL area remedial injections are accessible.

Criterion #7: Cost:

Includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

LNAPL Alternatives

Cost Category	**Alternative 1** ISCR and Enhanced Anaerobic Biodegradation	**Alternative 2** Air Sparging and Soil Vapor Extraction	**Alternative 3** Thermal Treatment
Capital Cost	$971,200	$3,725,250	$11,004,00
NPW O&M Costs	$2,735,700	$1,347,600	$3,374,400
NPW Total	$3,706,900	$5,072,850	$14,378,400
Notes: NPW Net present worth O&M Operation and maintenance			

Non-LNAPL Groundwater Alternatives:

Cost Category	**Alternative 1** Monitored Natural Attenuation	**Alternative 2** ISCR and Enhanced Anaerobic Biodegradation
Capital Cost	$213,600	$971,200
NPW O&M Costs	$729,000	$2,735,700
NPW Total	$942,600	$3,706,900
Notes: NPW Net present worth O&M Operation and maintenance		

Criterion #8: State Acceptance: ***Considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.***

The State of Georgia, as represented by GA EPD, has been actively involved in the process of determining and evaluating the T. H. Agriculture and Nutrition remedial alternatives. GA EPD has expressed support for the proposed amended remedy: A two phased approach which includes installation and operation of an AS/SVE system in the LNAPL area and implementation of ISCR and Enhanced Anaerobic Biodegradation in the non-LNAPL area.

Criterion #9: Community Acceptance:

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends. The EPA will address questions and comments in the responsiveness summary section of the Amended ROD.

Preferred Alternative

- EPA's Preferred Alternative to amend the groundwater remedy for OU-1 is **LNAPL Alternative 2: Air Sparging and Soil Vapor Extraction**, followed by **Non-LNAPL Groundwater Alternative 2: ISCR and Enhanced Anaerobic Biodegradation**. The preferred alternative will include two phases: 1) aggressive cleanup (i.e., remediation) of source areas (LNAPL plume and residual VOCs) followed by 2) remediation of residual pesticides in the dissolved phase groundwater. The preferred alternative consists of installation of approximately 85 air sparge wells and 62 soil vapor extraction wells followed by direct push injection of approximately 60,000 pounds of zero-valent-iron (ZVI), carbon substrate, and nutrients to chemically degrade dissolved and adsorbed COCs outside of the LNAPL area.

- The system will operate for two years after which the groundwater COC concentrations will be compared to baseline groundwater monitoring data. If the performance criteria are met, the system will operate for an additional six months, then temporarily deactivated to check contaminant rebound.
- The system will be deactivated if no contaminant rebound is measured in groundwater and other media.
- The system will be reactivated if contaminant rebound is observed or if contaminants have not achieved performance criteria. Reactivation for not achieving cleanup levels is anticipated for an additional 12 months and reactivation for rebound of contaminants is anticipated for an additional six months.
- ISCR will be implemented after the first Phase of the remedy to further reduce LNAPL and Non-LNAPL groundwater contaminant concentrations.
- Groundwater monitoring will be performed during and after implementation of the two phases to determine effectiveness of the treatment and whether groundwater cleanup levels are being attained throughout the plume.
- Institutional controls will be evaluated and implemented as part of the selected remedy. Likely institutional controls include the following: (1) recording an environmental covenant in accordance with State of Georgia Uniform Environmental Covenant Act regulations; (2) a notice of contamination in recorded deeds; (3) license agreements with landowners to prohibit use of the contaminated groundwater; and (4) other informational devices.
- The cost of the Preferred Remedy (both AS/SVE followed by ISCR) is estimated at $8,779,750.

The EPA intends to utilize a Remedy Management Flow Diagram to establish decision criteria for when one phase of the selected remedy has been determined to be effective and can be discontinued and the second phase implemented. Decision criteria will also be developed for determining when a remedy component should be optimized and whether additional injections are necessary, based upon monitoring information and other analysis. This plan and the flow chart were included in the Feasibility Study as Appendix E.

The Preferred Alternative is favored over the other alternatives because of its overall potential effectiveness and efficiency in addressing site contamination and achieving RAOs. In-situ AS/SVE (and subsequent ISCR) is a less complex technology to implement compared to thermal treatment technology. Furthermore, this remedy will provide high overall protection of human health and the environment, high long-term effectiveness, and greatly reduce toxicity, mobility, and volume of contaminant mass.

Based on the information available now, EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives evaluated with respect to the balancing and modifying criteria. EPA expects that the Preferred Alternative will satisfy the statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; 4) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element. The Preferred Alternative can change in response to public comments or new information.

Five-Year Review

Because hazardous substances, pollutants, or contaminants will remain at the Site above levels that allow for unlimited use and unrestricted exposure, EPA will continue to review the remedial actions taken at the Site no less than every five years per CERCLA Section 121(c) and the NCP at 40 C.F.R. 300.430(f)(4)(ii). If results of the five-year reviews reveal that remedy integrity is compromised and protection of human health and the environment is insufficient, EPA and GA EPD will evaluate the need for additional action.

Community Participation

The EPA is soliciting your involvement in selection of the site cleanup plan (i.e., remedy). The public is encouraged to submit to the EPA for consideration any comments pertaining to the Preferred Alternative, or the other remedial alternatives described in the Proposed Plan. The final decision regarding the selected remedy will be made after the EPA has taken into consideration all public comments. The EPA may select a remedy other than the proposed Preferred Alternative, based upon community input. The comments relevant to the Proposed Plan will be addressed in the responsiveness summary section of the ROD amendment.

EPA provides information regarding cleanup of the Site to the community through public meetings, the Administrative Record file for the Site, and updates to EPA's site profile page (https://www.epa.gov/superfund/t-h-agriculture). EPA and the state encourage the community to gain a more comprehensive understanding of the Site and Superfund activities conducted at the Site.

The front page of this Proposed Plan includes the dates for the public comment period and locations of the recorded presentation and the Administrative Record. For more information about the Site or to submit comments on the Proposed Plan, please contact Christopher Jones, Marjorie Thomas, or Donnica Wiley.

Christopher Jones, Remedial Project Manager
U.S. EPA, Region 4
61 Forsyth Street, SW, Atlanta, Georgia 30303
Phone: (404)-971-9838 or (800) 435-9233
E-mail: Jones.Christopher@epa.gov

Marjorie Thomas, Community Involvement Coordinator
U.S. EPA, Region 4
61 Forsyth Street, SW, Atlanta, Georgia 30303
Phone: (919) 407-9721 or (800) 435-9233
E-mail: Thomas.Marjorie@epa.gov

Donnica Wiley, Community Involvement Coordinator
U.S. EPA, Region 4
61 Forsyth Street, SW, Atlanta, Georgia 30303
Phone: (404) 562-8448 or (800) 435-9233
E-mail: Wiley.Donnica@epa.gov

DOCUMENT INFORMATION

The Administrative Record contains all the information used by the Agency to select a Remedial Action. Copies of the Administrative Record are retained at:

Dougherty County Public Library
300 Pine Avenue
Albany, Georgia 31701
Telephone: 229-420-3200
Hours: Mon – Fri: 10:00 AM - 5:30 PM;
Sat: 10 AM – 4:30 PM

U.S. Environmental Protection Agency Region IV - Records Center
61 Forsyth Street, SW Atlanta, Georgia 30303-3104
Phone: (404)562-8816
Hours: Mon - Fri 8 AM - 5 PM

GLOSSARY

Administrative Record: Materials, information and documents that provide the basis and support the EPA's selection of a remedial action at Superfund sites usually placed in the **information repository** near the Site.

Applicable or Relevant and Appropriate Requirements (ARARs): Refers to Federal and more stringent State environmental requirements a selected remedy must attain unless a waiver under CERCLA Section 121(d)(4) is justified which vary from site to site. Reference 40 CFR 300.5 Definitions of 'Applicable requirements' and 'Relevant and appropriate requirements.'

Baseline Risk Assessment (BRA): A qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and the environment by the presence or potential presence and use of specific pollutants.

Chemical of Concern (COCs): Chemical constituents associated with a Superfund Site that have been released into the environment and pose an unacceptable risk to human health.

bgs (below ground surface)

Chemical of Potential Concern (COPC): is generally a contaminant which may or may not be causing risk or adverse effects to the plants and animals at a site.

Chemical of Potential Ecological Concern (COPEC): Any contaminant that is shown to pose possible ecological risk to a site.

Cleanup: Actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and/or the environment. The term "cleanup" is sometimes used interchangeably with the terms remedial action, removal action, response action, or corrective action.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): Also known as **Superfund**, is a federal law passed in 1980 and modified in 1986 by the Superfund Amendment and Reauthorization Act (SARA). The act created a trust fund, to investigate and cleanup abandoned or uncontrolled hazardous waste sites.

Ecological Risk Assessment (ERA): A qualitative and quantitative evaluation performed in an effort to define the risk posed to ecological receptors by the presence or potential presence of specific contaminants.

Feasibility Study: Study conducted after the Remedial Investigation to determine what remedial alternatives or technologies could be applicable to the site-specific COCs.

Groundwater: Water located beneath the ground surface in soil pore spaces and in the fractures of lithologic formations.

Human Health Risk Assessment (HHRA). The process used to estimate the nature and probability of adverse health effects in humans who may be exposed to hazards in contaminated environmental media, now or in the future.

Information Repository: A library or other location where documents and data related to a Superfund project is placed to allow public access to the material.

In-situ chemical reduction (ISCR)

Institutional Controls: Administrative, non-engineering, controls that inform and prevent exposures to human receptors.

Monitoring: The periodic or continuous surveillance or testing to determine the level of pollutants in various media.

LNAPL: Light Non-aqueous phase liquid. Non-aqueous phase liquids or NAPLs are liquid solution contaminants that do not dissolve in or easily mix with water (hydrophobic), like oil, gasoline and petroleum products.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The federal regulation that guides the Superfund program.

Proposed Plan: Document that summarizes the RI/FS, the alternatives developed and the proposed Preferred Remedial Alternative and the rationale for its proposal**.**

Public Comment Period: The time allowed for the public to express their views and concerns on the information provided in the Proposed Plan and the EPA's proposed Preferred Remedial Alternative.

Resource Conservation and Recovery Act (RCRA): Federal environmental law passed by Congress in 1976 and later amended in 1984 that governs the generation, storage, treatment and disposal of solid and hazardous wastes. Some CERCLA sites are contaminated with RCRA wastes or activities as part of the response action include management of RCRA wastes.

Record of Decision (ROD): A decision document that selects and describes the remedy that will be implemented at

a Site. The ROD is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments.
Remedial Action (RA): The actual construction or implementation phase of a Superfund site cleanup that follows remedial design.
Remedial Action Objectives (RAOs): Provide a general description of what the cleanup will accomplish (e.g., restoration of groundwater to drinking water levels). These goals typically serve as the basis for developing remedial alternatives.
Remedial Design (RD): The development of engineering drawings and specifications for the implementation and construction of a remedial action.
Remedial Investigation (RI): An investigation conducted to fully characterize the nature and extent of contamination of a release, or threat of release, of hazardous substances, pollutants, or contaminants. In addition, the RI also evaluates risks posed to human health and the environment. The RI gathers the necessary data to support the corresponding FS.
Selected Remedy: The chosen Superfund cleanup plan.
Response Action: A CERCLA-authorized action involving either a short-term removal action or a long-term removal response. This may include but is not limited to removing hazardous materials from a site to an EPA-approved hazardous waste facility for treatment, containment or treating the waste on-site, identifying and removing the sources of groundwater contamination and halting further migration of contaminants.
Superfund: The common name used for the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended in 1986.

WHAT IS RISK AND HOW IS IT CALCULATED?

Human Health Risk

A Superfund human health risk assessment estimated the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a Superfund site, the EPA undertakes a four-step process.

Step 1: Analyze Contamination

The EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help the EPA to determine which contaminants are most likely to pose the greatest threat to human health.

Step 2: Estimate Exposure

The EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of the exposure. Using the information, the EPA calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

Step 3: Assess Potential Health Dangers

The EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. The EPA considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of excess cancer risk resulting from a Superfund site is generally expressed as an upper bound of probability; for example, a "1 in 10,000" chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. The EPA's target range for acceptable cancer risk is "1 in 1,000,000" to "1 in 10,000." These probabilities are often expressed in scientific notation (i.e., 1×10^{-6} to 1×10^{-4}). An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, the EPA calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index less than 1) exists below which non-cancer health effects are no longer predicted.

Step 4: Characterize Site Risk

The EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated, and summarized.

Ecological Risk

Currently, the EPA guidance recommends an eight-step process for designing and conducting ecological risk assessments (ERAs) for the Superfund Program.

Steps 1 and 2: These Steps constitute a screening level ecological risk assessment (SLERA), which compares existing site data to conservative screening level values to identify those chemicals which can confidently be eliminated from further evaluation, and those for which additional evaluation is warranted. At the end of Step 2, all involved parties meet and discuss whether: there is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk.

Step 3: If the information from Step 2 is not adequate to make a decision at this point, Step 3 of the eight-step process is initiated as the planning and scoping phase for implementing a baseline ecological risk assessment (BERA). Step 3 includes several activities, including refinement of the list of contaminants of potential concern (COPCs), further characterization of ecological effects, refinement of information regarding contaminant fate and transport, complete exposure pathways, ecosystems potentially at risk, selecting assessment endpoints, and developing a conceptual model with working hypotheses or questions that the site investigation will address.

Step 4: A sampling and analysis plan (SAP) is developed and used to gather further data to support the BERA.

Step 5: Conduct a site visit to verify the Step 4 sampling design.

Step 6: Data collection for the BERA.

Step 7: The summary and analysis of the data, and prediction of the likelihood of adverse effects based on the data analysis, which is presented as the risk characterization. It also includes consideration of uncertainties and ecological significance of risks in view of the types and magnitude of effects, spatial and temporal patterns, and likelihood of recovery.

Step 8: The final step, results in a discussion of significant risks, recommended cleanup (if any), and future efforts.

ATTACHMENT 1

Figures

Figure 2 LNAPL Plume

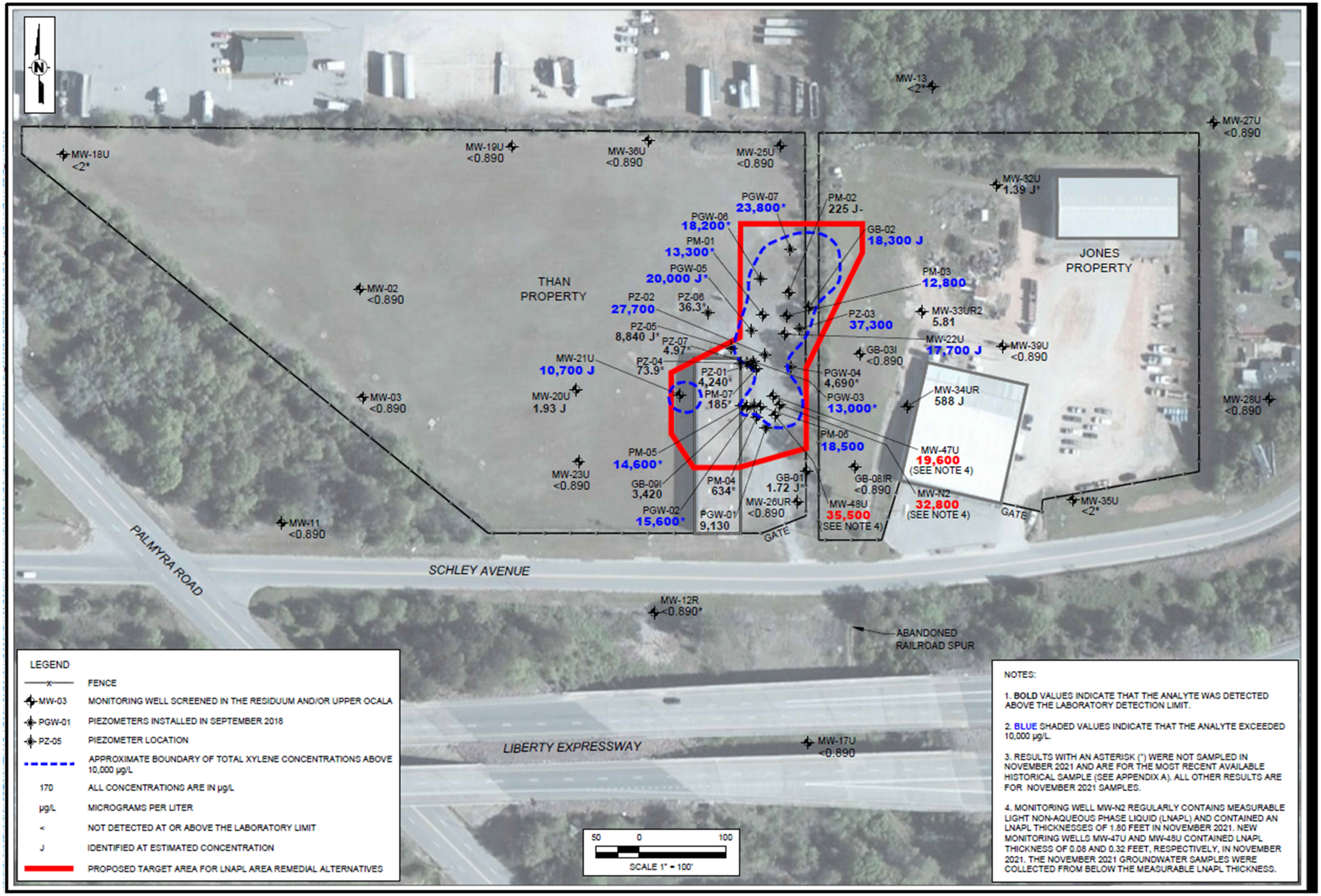


Figure 3 Preliminary Air Sparge Well Layout

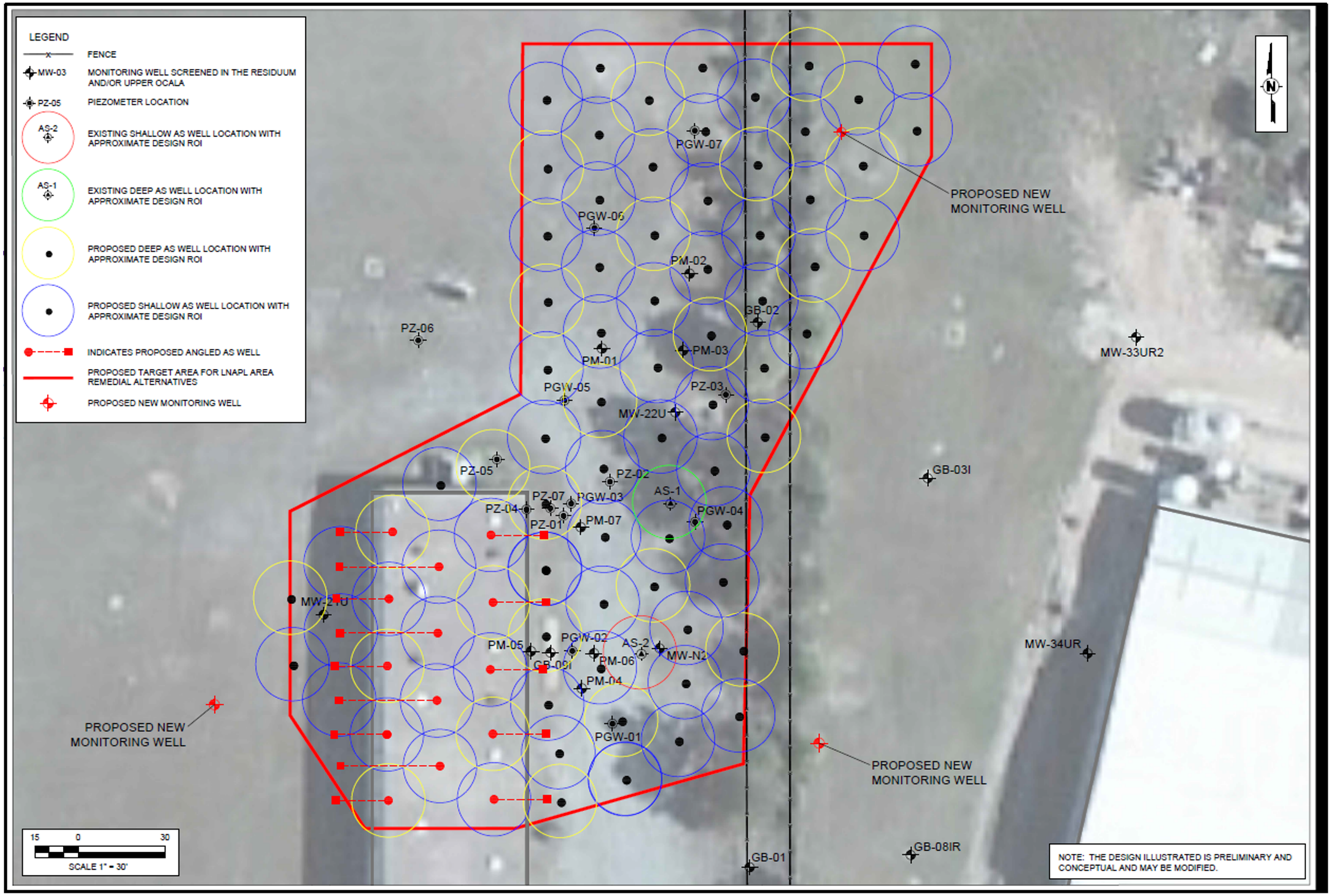


Figure 4 Preliminary Soil Vapor Extraction Well Layout

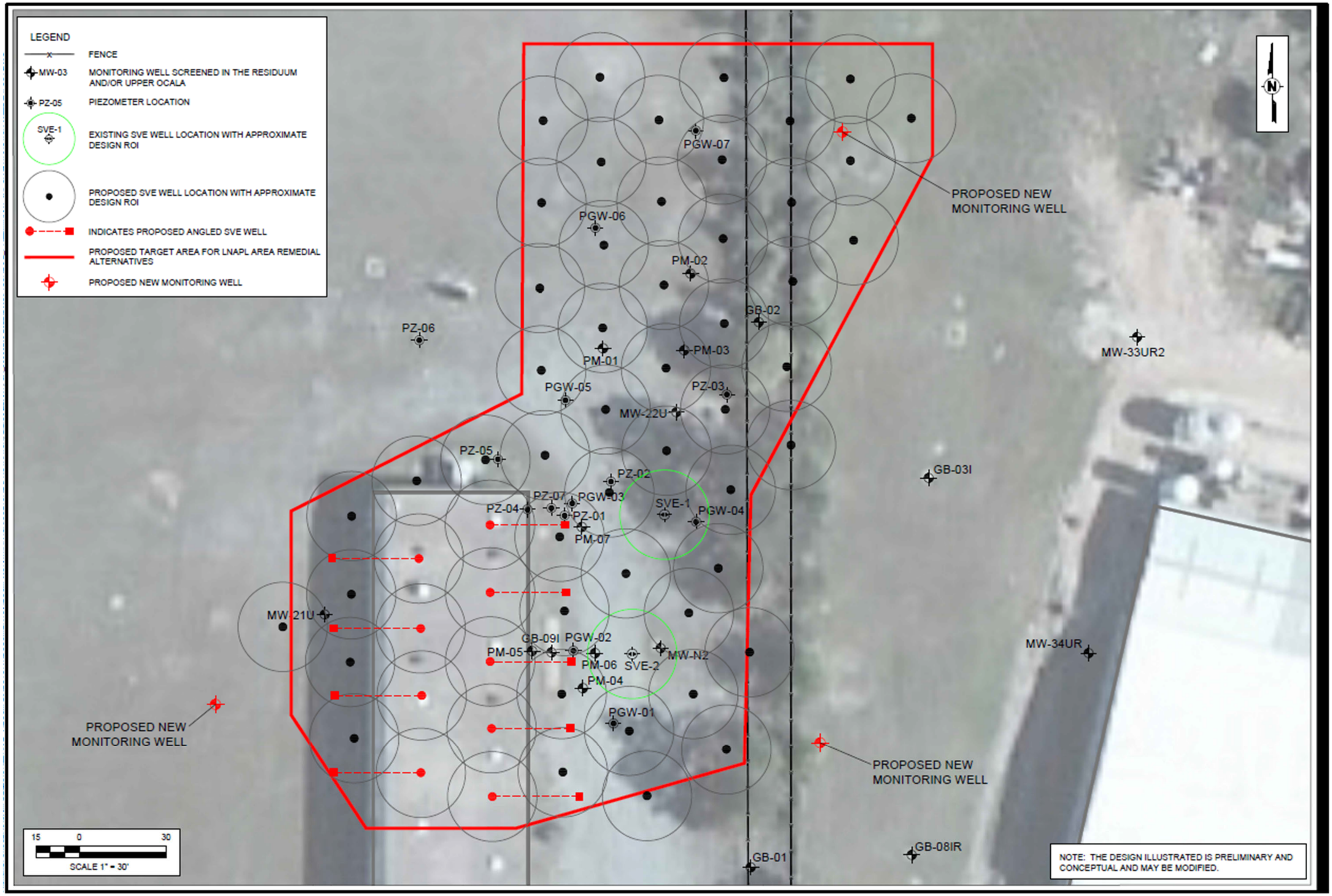


Figure 5 Non-LNAPL Plume